

REMARKS

Claims 1-16, 18-22, and 24-42 are now pending in the instant application. In the most recent Office Action, Claims 1-3, 5, 6, 8, 9 and 12-41 are rejected under 35 USC § 103(a) as allegedly being obvious over U.S. Patent No. 6,344,883 to Yamada, et al. (hereinafter, “Yamada”). Claim 7 is rejected under 35 USC § 103(a) as allegedly being obvious over Yamada in view of U.S. Patent No. 4,938,569 to Tsunoda, et al. (hereinafter, “Tsunoda”). Claims 28 and 32 are objected to for minor informalities.

At the outset, Applicant gratefully acknowledges the Examiner’s indication of allowable subject matter in Claims 4, 10 and 11. As a threshold matter, Claim 14 depends from Claim 13, which in turn depends from Claim 10. Therefore, Claims 13 and 14 both incorporate by reference each and every feature recited in Claim 10. By the Examiner’s indication, Claims 13 and 14 should be allowable for at least the same reasons as Claim 10. Favorable reconsideration and withdrawal of the rejection is kindly requested.

As amended above, the phrase “counter pixel” has been replaced with the phrase - counter electrode - in Claims 28 and 32, as indicated by the Examiner. Favorable reconsideration and withdrawal of the objection is kindly requested.

In the above amendment, the phase “columnar spacers” has been amended to read - at least one columnar spacer - in Claims 1, 5, 18, 25, 34, 35, 36 and 37. This amendment finds support throughout the specification generally, and specifically in the figures, among other places. No new matter has been added.

Claims 1 and 5, as amended above, each recite a multi-domain alignment active-matrix liquid crystal display device comprising, *inter alia*, at least one columnar spacer having a diameter varying along its axis provided between two opposing plates. This amendment to the claims finds support generally throughout the specification, and specifically at, among other places, p. 9, lines 15-16. No new matter has been added.

In contrast to the claimed invention, Yamada teaches spacers (65, Figs. 12A, 12B; 135, Figs. 19A, 19B) which are merely cylindrical, and have no variation in diameter along their axis. To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *See, In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). Applicant respectfully submits that Yamada neither teaches nor suggests spacers which vary in diameter along their axis. Therefore, Applicant respectfully submits that Claims 1 and 5 are patentably distinguished over the prior art. Claims 2-4, 15 and 6-14, 16 depend from Claims 1 and 5, respectively, and are therefore submitted as patentable for at least the same reasons. Favorable reconsideration and withdrawal of the rejection is kindly requested.

Regarding Claim 7, Tsunoda is offered for its teaching of an orientation layer formed by the oblique vapor deposition of SiO. However, Tsunoda offers no teaching or suggestion to ameliorate the deficiencies of Yamada relative to Claim 5 as illustrated, *supra*. Therefore, Applicant respectfully submits that Claim 7 is further distinguished over both Yamada and/or Tsunoda, either alone or in combination. Favorable reconsideration and withdrawal of the rejection is kindly requested.

As amended, Claims 18 and 25 have been rewritten into independent form, including only the features previously recited. No new matter has been added by this

amendment. Claims 18 and 25 each recite a multi-domain alignment active-matrix liquid crystal display device comprising, *inter alia*, at least one columnar spacer disposed approximately at a center of said orientation layer on a pixel. As can clearly be seen in Figs.12B, 19B, 22B and 25B of Yamada, all spacers are clearly located at a periphery of the pixel orientation layer, not at a center, as recited in the claims. Yamada neither teaches nor suggests a spacer disposed approximately at a center of said orientation layer on a pixel. Therefore, Applicant respectfully submits that Claims 18 and 25 are patentably distinguished over the prior art. *See, Royka, supra.* Claims 19-22 and 24, 26-33 depend from Claims 18 and 25, respectively, and are therefore submitted as patentable for at least the same reasons.

Claim 34, as amended, recites a multi-domain alignment active-matrix liquid crystal display device comprising, *inter alia*, at least one columnar spacer having a side surface that is slanted or inclined. This amendment to the claims finds support generally throughout the specification, and specifically at, among other places, p. 15, lines 15-16. No new matter has been added.

In contrast to the claimed invention, Yamada teaches spacers that are right cylindrical, and not inclined in any direction. *See, e.g., Figs. 12A, 12B and Figs. 19A, 19B.* Yamada neither teaches nor suggests spacers which are inclined or slanted. Therefore, Applicant respectfully submits that Claim 34 is patentably distinguished over the prior art. *See, Royka, supra.* Claims 35-41 depend from Claims 1 and 5, respectively, and are therefore submitted as patentable for at least the same reasons. Reconsideration and withdrawal of the rejection is kindly requested.

Regarding new claim 42, this claims recites a multi-domain alignment active-matrix liquid crystal display device comprising, *inter alia*, at least one columnar spacer is provided on said orientation layer. This claim finds support generally throughout the specification, and specifically at, among other places, Fig. 1. No new matter has been added. This is neither taught nor suggested in the prior art.

In contrast to the claimed invention, Yamada, for example, teaches in Figs.12A, 18, 19A, 22A and 25A, and their accompanying description, that the orientation layer is disposed over the columnar spacers. This is the opposite of the claimed configuration. Therefore, Applicant respectfully submits that Claim 42 is patentably distinguished over the prior art.

In light of the foregoing, Applicant respectfully submits that all claims define patentable subject matter, and kindly solicits and early indication of allowability.

Respectfully Submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS

Please cancel Claims 17 and 23 without prejudice or disclaimer.

Please amend Claims 1-3, 5, 8, 18, 24-26, 28, 30, 32 and 34-38 to read as follows:

1. (Amended) A multi-domain alignment active-matrix liquid crystal display device comprising;

 first and second transparent insulating plates arranged to oppose each other;
 said first plate having disposed thereon a plurality of scanning lines and a plurality of signal lines, thin-film transistors provided in the vicinity of intersections between the scanning lines and signal lines, and pixel electrodes connected to the thin-film transistors;

 said second plate having a black matrix provided with openings at areas that oppose said pixel electrodes, a color layer and counterelectrodes provided so as to oppose said pixel electrodes;

 a liquid crystal being sandwiched between the opposing first and second plates and being control led by voltage impressed across said pixel electrodes and said counterelectrodes;

 wherein an orientation layer is provided on each pixel electrode of said first plate

via an insulating film,

wherein said orientation layer is formed into a curved surface and orient molecules of the liquid crystal aligned in a direction normal to the curved surface of said orientation layer, and

wherein [columnar spacers are] at least one columnar spacer having a diameter varying along its axis is provided between the two opposing plates for regulating a panel gap therebetween.

2. (Amended) The device according to claim 1, wherein said at least one columnar spacer has an end portion on one side thereof that is disposed approximately at a center of said orientation layer formed on said first plate.

3. (Amended) The device according to claim 2, wherein said orientation layer formed on said first plate defines a cavity recessed toward said first plate in a cross section taken along a line normal to said plate; and

wherein said [columnar spacer] at least one columnar spacer has a diameter that becomes progressively smaller in the direction of said second plate.

5. (Amended) A multi-domain alignment active-matrix liquid crystal display device comprising first and second transparent insulating plates arranged to oppose each other; said first plate having disposed thereon a plurality of scanning lines and a plurality of signal lines, thin-film transistors provided in the vicinity of intersections between the scanning lines and signal lines, and pixel electrodes connected to the thin-film transistors;

said second plate having a black matrix provided with openings at areas that oppose said pixel electrodes, a color layer and counterelectrodes provided so as to oppose said pixel electrodes;

 a liquid crystal being sandwiched between the opposing first and second plates and being controlled by voltage impressed across said pixel electrodes and said counterelectrodes

 wherein each of said pixel electrodes on said first plate and an orientation layer formed on said pixel electrode defines a curved surface, and

 wherein [columnar spacers are] at least one columnar spacer having a diameter varying along its axis is provided between the two opposing plates for regulating a panel gap therebetween.

8. (Amended) The device according to claim 5, wherein said at least one columnar spacer has an end portion on one side thereof that is disposed approximately at the center of the pixel electrode formed on said first plate.

18. (Amended) [The device according to claim 17, wherein] A multi-domain alignment active-matrix liquid crystal display device comprising:

first and second transparent plates arranged to oppose each other;
 a liquid crystal being sandwiched between the first and second plates, and
 pixel electrodes disposed on one of said plates and
 counterelectrodes disposed on the other of said plates and adapted to apply voltage to the
 liquid crystal across the pixel electrodes and the counterelectrodes;
 wherein an orientation layer is provided on each pixel electrode of one of said

plates via an insulating film,

wherein said orientation layer is formed into a curved or slanted surface so as to orient molecules of the liquid crystal in a direction normal to the curved or slanted surface of said orientation layer, and

wherein at least one columnar spacer is provided between the two opposing plates for regulating a panel gap between said plates, said [columnar spacers are] at least one columnar spacer disposed approximately at a center of said orientation layer on a pixel.

24. (Amended) The device according to claim [23] 25, wherein said orientation layer is adapted to orient the liquid crystal molecules substantially at right angles to the planes of said plates.

25. (Amended) [The device according to claim 23, wherein] A multi-domain alignment active-matrix liquid crystal display device comprising:

first and second transparent plates arranged to oppose each other;
a liquid crystal being sandwiched between the first and second plates, and
pixel electrodes disposed on one of said plates and counterelectrodes disposed on the other of said plates and adapted to apply voltage to the liquid crystal across the pixel electrode and the counterelectrodes;

wherein an orientation layer is provided on each pixel electrode of one of said plates;

wherein said orientation layer and said pixel electrode are formed into a curved or slanted surface;

wherein at least one columnar spacer having a diameter that varies along its axis is provided between the two opposing plates for regulating a panel gap between said plates, and said [columnar spacers are] at least one columnar spacer disposed approximately at a center of said orientation layer on a pixel.

26. (Amended) The device according to claim [23] 25, wherein said pixel electrode defines a cavity recessed toward the counterelectrode.

28. (Amended) The device according to claim 27, wherein said columnar spacer has a diameter increasing toward the counterelectrode [pixel] opposing the pixel electrode.

30. (Amended) The device according to claim [23] 25, wherein said pixel electrode defines a curved or slanted protrusion protruding toward the counterelectrode.

32. (Amended) The device according to claim 31, wherein said columnar spacer has a diameter decreasing toward the counterelectrode [pixel] opposing the pixel electrode.

34. (Amended) A multi-domain alignment active-matrix liquid crystal display device comprising;

first and second transparent plates arranged to oppose each other;
a liquid crystal being sandwiched between the first and second plates, and
pixel electrodes disposed on one of said plates and counterelectrodes disposed on the other of said plates and adapted to apply voltage to the liquid crystal across the pixel electrodes and the counterelectrodes;

wherein an orientation layer is provided at least on each pixel electrode disposed on one of said plates, and

wherein [columnar spacers are] at least one columnar spacer having a side surface that is slanted or inclined is provided between the two opposing plates for regulating a panel gap between said plates.

35. (Amended) The device according to claim 34, wherein said side surface of said at least one columnar spacer[s] [have a side wall] is adapted to pre-align molecules of the liquid crystal surrounding each of the columnar spacers centering thereat.

36. (Amended) The device according to claim 35, wherein said at least one columnar spacer[s] [have] has a diameter varying along its axis.

37. (Amended) The device according to claim 35, wherein said at least one columnar spacer[s] [have] has a diameter decreasing or increasing toward one end thereof.

38. (Amended) The device according to claim 35, wherein said side [wall] surface is adapted to pre-align molecules of the liquid crystal substantially parallel to the sidewall.

Please add the following new Claim 42:

42. (New) A multi-domain alignment active-matrix liquid crystal display device comprising:

first and second transparent plates arranged to oppose each other;

a liquid crystal being sandwiched between the first and second plates, and

pixel electrodes disposed on one of said plates and counterelectrodes disposed on the other of said plates and adapted to apply voltage to the liquid crystal across the pixel electrodes and the counterelectrodes;

wherein an orientation layer is provided at least on each pixel electrode disposed on one of said plates, and

wherein at least one columnar spacer is provided on said orientation layer between the two opposing plates for regulating a panel gap between said plates.